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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/661,435	09/12/2003	James J. Morehead	LEL-007	8144

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JOSHUA D. ISENBERG
204 CASTRO LANE
FREMONT, CA 94539

EXAMINER	
VAN ROY, TOD THOMAS	
ART UNIT	**PAPER NUMBER**
2828	

DATE MAILED: 07/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/661,435	MOREHEAD ET AL.
	Examiner	Art Unit
	Tod T. Van Roy	2828

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09/12/2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *09/12/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

The drawings are objected to because Figure 1 is thought to contain 2 lines, according to page 11 of the disclosure, although only 1 line is visible. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is objected to because of the following informalities:

Lines 7 and 12 on page 18 refer to element "506B", and it is believed that they should more properly refer to element "506A" based on the figures.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 15-22, 25, and 36 are rejected under 35 U.S.C. 102(b) as being anticipated by Shoji et al. ("Intrinsic Reduction of the Depolarization Loss in Solid-state Lasers by use of a (100)-cut Y3Al5O12 Crystal," by Ichiro Shoji and Takunori Taira. Applied Physics Letters. Vol. 80, No. 17, 29 April 2002).

With respect to claim 15, Shoji discloses a method for reducing depolarization loss in a gain medium in a laser or optical amplifier comprising: a crystal (col.1 lines 11-13) characterized by an orientation such that a <100> (referred to throughout) plane of the crystal is oriented substantially perpendicular with respect to a direction of beam propagation within the crystal (evaluation done in this plane as discussed in col.1 lines 17-19), wherein the crystal absorbs a power less than or equal to about 1000 watts of pumping radiation (figs.4,5 disclosing advantages of the <100> orientation over the others at values less than 1000 watts) and/or a cross-sectional overlap between a beam of radiation propagating through the crystal and a pumped region of the crystal, is

greater than about 20% of a cross-sectional area of the pumped region of the crystal, wherein the use of the substantially <100>-oriented crystal reduces depolarization loss or thermal lensing compared to a substantially similarly configured gain medium made from the same material as the substantially <l00> oriented crystal but having instead a substantially non-<l00> orientation (figs.4,5 and col.4 lines 29-31, and col.6 lines 5-10, speaking of the advantages of <100> orientation as compared with other substantially non-<100> orientations), and additionally discloses the crystal be pumped (col.5 lines 1-2).

With respect to claim 16, Shoji discloses that the diameter of the beam of radiation propagating through the crystal is greater than about 45% of a diameter of the crystal (col.3 lines 19-21, beam radius equaling the entire rod radius).

With respect to claims 17-22, Shoji discloses the crystal to be of Nd:YAG (col.1 line 12), which is birefringent, and has a simple cubic structure.

With respect to claim 25, Shoji discloses the gain medium be orientated such that the polarization of the stimulated radiation is directed substantially along a diagonal between two crystal axes other than the <100> axis (Shoji, fig.4 col.4 lines 5-12).

With respect to claim 36, Shoji discloses a gain medium in the form of a crystal (col.1 lines 11-13) characterized by an orientation such that a <100> (referred to throughout) plane of the crystal is oriented substantially perpendicular with respect to a direction of beam propagation within the crystal (evaluation done in this plane as discussed in col.1 lines 17-19), wherein the crystal absorbs a power less than or equal to about 1000 watts of pumping radiation (figs.4,5 disclosing advantages of the <100>

orientation over the others at values less than 1000 watts) and/or a cross-sectional overlap between a beam of radiation propagating through the crystal and a pumped region of the crystal, is greater than about 20% of a cross-sectional area of the pumped region of the crystal, wherein the use of the substantially <100>-oriented crystal reduces depolarization loss or thermal lensing compared to a substantially similarly configured gain medium made from the same material as the substantially <l00> oriented crystal but having instead a substantially non-<l00> orientation (figs.4,5 and col.4 lines 29-31, and col.6 lines 5-10, speaking of the advantages of <100> orientation as compared with other substantially non-<100> orientations), and additionally discloses the crystal be pumped (col.5 lines 1-2), completing the amplifier means, and further discloses a use of the material would be in an amplifier (col.1 lines 1-3).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-14, 23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shoji et al. ("Intrinsic Reduction of the Depolarization Loss in Solid-state Lasers by use of a (100)-cut Y3Al5O12 Crystal," by Ichiro Shoji and Takunori Taira. Applied Physics Letters. Vol. 80, No. 17, 29 April 2002) in view of Grossman et al. (US5850407).

With respect to claims 1, 10 and 26, Shoji teaches a gain medium in the form of a crystal (col.1 lines 11-13) characterized by an orientation such that a <100> (referred to throughout) plane of the crystal is oriented substantially perpendicular with respect to a direction of beam propagation within the crystal (evaluation done in this plane as discussed in col.1 lines 17-19), wherein the crystal absorbs a power less than or equal to about 1000 watts of pumping radiation (figs.4,5 disclosing advantages of the <100> orientation over the others at values less than 1000 watts) and/or a cross-sectional overlap between a beam of radiation propagating through the crystal and a pumped region of the crystal, is greater than about 20% of a cross-sectional area of the pumped region of the crystal, wherein the use of the substantially <100>-oriented crystal reduces depolarization loss or thermal lensing compared to a substantially similarly configured gain medium made from the same material as the substantially <l00> oriented crystal but having instead a substantially non-<l00> orientation (figs.4,5 and col.4 lines 29-31, and col.6 lines 5-10, speaking of the advantages of <100> orientation as compared with other substantially non-<100> orientations), and additionally discloses the crystal be

pumped (col.5 lines 1-2). Shoji does not teach the crystal to be in a resonant cavity between two or more reflecting surfaces. Grossman teaches a Nd:YAG crystal in a resonant cavity between two or more reflecting surfaces (fig.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the <100> orientated crystal gain medium of Shoji with the resonant cavity and reflectors of Grossman in order to provided feedback of light through the gain material of the crystal, to obtain a coherent light beam (laser), as is well known to those of ordinary skill in the art.

With respect to claims 2 and 27, Shoji and Grossman teach the laser device as outlined in the rejection to claims 1 and 26, and further teach that the diameter of the beam of radiation propagating through the crystal is greater than about 45% of a diameter of the crystal (col.3 lines 19-21, beam radius equaling the entire rod radius).

With respect to claims 3-8, and 28-33, Shoji and Grossman teach the laser device as outlined in the rejection to claims 1 and 26, and further teach the crystal to be of Nd:YAG (col.1 line 12), which is birefringent, and has a simple cubic structure.

With respect to claim 9, Shoji and Grossman teach the laser device as outlined in the rejection to claims 1 and 26, and further teach the crystal to be pumped parallel to the direction of propagation (col.6 lines 2-4, end pumped).

With respect to claim 11, Shoji and Grossman teach the laser device as outlined in the rejection to claim 10, and Grossman further teaches the laser medium to have Brewster angle surfaces (col.3 lines 40-52) wherein the surfaces inherently allow for a beam of substantially elliptical cross-section to propagate through the crystal. It would

have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the Brewster angled surfaces of Grossman into the laser medium in order to allow for polarization selection of return light into the medium (Grossman, col.3 lines 40-52) for further control of the polarization of light propagating through the crystal.

With respect to claims 12 and 13, Shoji and Grossman teach the laser device as outlined in the rejection to claim 1, and Grossman further teaches disposing first and second non-linear elements in the cavity such that the laser is frequency tripled (fig.1, abs.). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the first and second optical elements to frequency triple the laser to generate a UV light source (Grossman, abs.), and place the elements inside of the cavity to allow for the return of fundamental light (Grossman, col.2 lines 38-40, speaking of separating out of the fundamental light, allowing for it to remain in the cavity), not frequency converted, to additionally pump the active medium and reduce the overall system losses.

With respect to claims 14 and 35, Shoji and Grossman teach the laser device as outlined in the rejection to claims 1 and 26, and further teach the gain medium be orientated such that the polarization of the stimulated radiation is directed substantially along a diagonal between two crystal axes other than the <100> axis (Shoji, fig.4 col.4 lines 5-12).

With respect to claim 23, Shoji teaches the method outlined in the rejection to claim 15 above, but does not disclose the crystal to be disposed within an optical cavity of a laser. Grossman teaches a Nd:YAG crystal in a resonant cavity between two or

more reflecting surfaces (fig.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the <100> orientated crystal gain medium of Shoji with the resonant cavity and reflectors of Grossman in order to provided feedback of light through the gain material of the crystal, to obtain a coherent light beam (laser), as is well known to those of ordinary skill in the art.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shoji in view of Bowman (US 6370172).

With respect to claim 24, Shoji teaches the method as outlined in the rejection to claim 15 above, but does not teach the crystal to be side pumped. Bowman teaches a YAG crystal (col.7 lines 51-53) wherein the medium is side pumped (fig.3). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the method of Shoji with the side pumping of Bowman to minimize the fluence and reduce the risk of optically damaging the crystal (Bowman, col.6 lines 41-46).

Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shoji in view of Grossman and further in view of Bowman.

With respect to claim 34, Shoji and Grossman teach the use of the crystal as outlined in the rejection to claim 26 above, but do not teach the crystal to be side pumped. Bowman teaches a YAG crystal (col.7 lines 51-53) wherein the medium is side pumped (fig.3). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the crystal use of Shoji and Grossman with the side

pumping of Bowman to minimize the fluence and reduce the risk of optically damaging the crystal (Bowman, col.6 lines 41-46).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR

MINSUN OH HARVEY
PRIMARY EXAMINER